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FORAGE AND CATTLE MANAGEMENT IN LONGLEAF-SLASH PINE FORESTS



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FORAGE AND CATTLE MANAGEMENT IN LONGLEAF-SLASH PINE FORESTS

by L. K. HALLS, R. H. HUGHES, R. S. RUMMELL, and B. L. SOUTHWELL¹

Forage is one of several important products of longleaf-slash pine forest lands. Overall, timber is the main crop. But the forage supports livestock that contribute substantially to the South's economy.

Profitable forest range grazing operations do not just happen. The cattle manager must understand the range and livestock so that he can:

- Estimate the amount and nutritional value of the forage at various seasons;
- Feed supplements and minerals when they are needed;
- Distribute the herd over the range so as to take full advantage of the forage and avoid overgrazing;
- Prevent damage to timber, watersheds, and wildlife habitat;
- Improve the breeding and quality of the animals;
- Keep the herd healthy and productive.

The information in this bulletin applies specifically to range forage and cattle in the 26.5 million acres of longleaf and slash pine forests. It also has general application to the bluestem forage in the bordering 58.5 million acres of loblolly-shortleaf pine and 22.9 million acres of oak-pine. Approximately 3 million cattle are now grazed in the longleaf-slash pine forests. In southern Florida, herds of 200 or more head are common; elsewhere the average herd is generally less than 50, but the trend is toward consolidation. Nine-tenths of the land is in private ownership. Herd owner and landowner are often different persons, but cattle frequently fit into the interests of both.

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Forage and Its Management

Forage Species

Longleaf-slash pine forests contain two major forage types (fig. 1). Longleaf pine-bluestem range is commonly known as the bluestem type. The most important forage species are pinehill bluestem and slender bluestem. In the longleaf-slash pine-pineland threeawn type, the most prevalent grasses are pineland threeawn (locally called wiregrass), Curtiss dropseed, slender bluestem, and creeping bluestem.

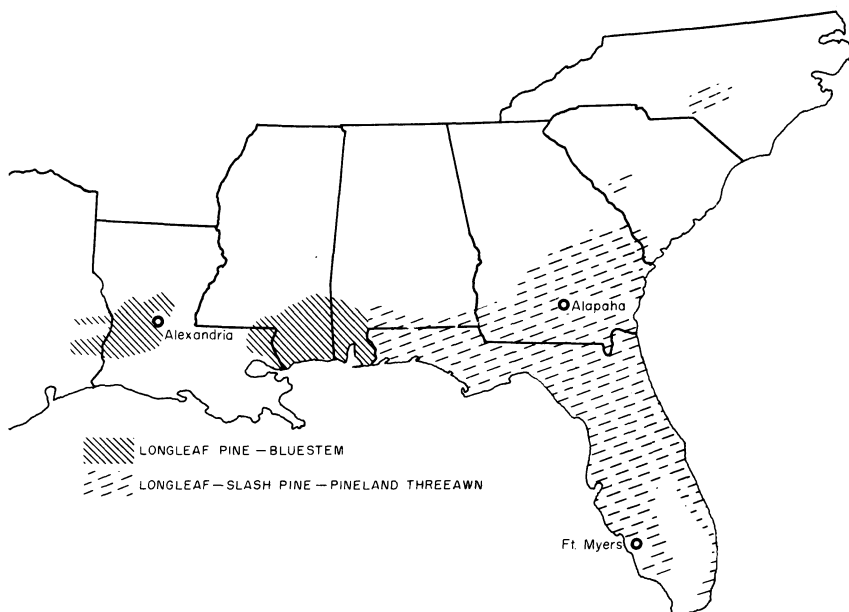


FIGURE 1.—Range types of longleaf and slash pine forests. The U.S. Forest Service has forest range research installations at Alexandria, La.; Alapaha, Ga.; and Fort Myers, Fla.

The bulk of the forage grows on upland soils, most of which have a sandy or sandy loam surface layer and slow internal drainage. Many interlaced drainageways and swamps harbor a wide variety of forbs and browse, among which are evergreen and semievergreen species particularly valuable during winter. These areas are also a main source of food and cover for game.

The principal forage plants, their prevalence, site preference, and season of greatest use by cattle are listed in table 1. Range forage plants are commonly divided into three groups: Grasses, forbs (broad-leaved herbs), and browse (shrubs or young trees). A good variety of forage helps to balance the cattle diet, and a mixture of warm- and cool-season plants lengthens the availability of green feed. Equally important with season of use is quality of the forage.

TABLE 1.—Principal forage plants in longleaf-slash pine forest ranges

Species	Prevalence ¹	Site preference	Season of greatest use
GRASSES:			
Goobergoass (<i>Amphicarpum mühlenbergianum</i>)	South Carolina and Florida. Scattered.	Low moist sites	Summer.
Pinehill bluestem (<i>Andropogon divergens</i>)	Mississippi to Texas. Abundant.	Well-drained slopes and sandy ridges.	Spring and summer, but some all year.
Big bluestem (<i>A. gerardii</i>)	Scattered	Moist to dry sandy soils.	Summer and fall.
Little bluestem (<i>A. scoparius</i>)	Scattered	Moist to dry sandy soils.	Spring and summer.
Creeping bluestem (<i>A. stolonifer</i>)	Alabama eastward. Abundant.	Moist to dry sandy soils.	Summer.
Slender bluestem (<i>A. tener</i>)	Abundant	All except wet places.	Spring, early summer.
Pineland threawn (<i>Aristida stricta</i>)	Mississippi eastward. Abundant.	Moist to dry sandy soils.	Late winter and early spring.
Giant cane (<i>Arundinaria gigantea</i>)	Scattered	Low moist areas and alluvial soils along streams.	Summer.
Carpetgrass (<i>Axonopus affinis</i>)	Common	Moist ground, roadsides, and waste places.	Spring and summer.
Panicgrasses (<i>Panicum</i> spp.)	Abundant	All sites	Late winter and early spring.
Cutthroat grass (<i>P. abscessum</i>)	Central Florida. Scattered.	Sandy soils or swamps.	Spring and summer.
Maidencane (<i>P. hemitomon</i>)	Near coast. Common	Marshes and wet sites in pine forests.	Winter.
Switchgrass (<i>P. virgatum</i>)	Common	Moist areas and along streams.	Spring and summer.
Paspalum (<i>Paspalum</i> spp.)	Common	All sites	Spring and summer.
Lopside Indiangrass (<i>Sorghastrum secundum</i>)	Mostly in east.	Moist to dry sandy soils.	Summer and fall.
Curtiss dropseed (<i>Sporobolus curtisii</i>)	Flatwoods of Georgia, Florida, and South Carolina. Abundant.	Moist to dry sandy soils.	Late fall and winter.

TABLE 1.—Principal forage plants in longleaf-slash pine forest ranges—Continued

Species	Prevalence ¹	Site preference	Season of greatest use
Pineywoods dropseed (<i>S. junceus</i>)	Common	All except wet sites	Spring.
FORBS:			
Tickclover (<i>Desmodium</i> spp.)	Scattered	All except wet sites	Summer through fall.
Swamp sunflower (<i>Helianthus angustifolius</i>)	Common	Moist sites	Spring through fall.
Common lespedeza (<i>Lepedeza striata</i>)	Scattered	Roadsides, pastures on all except wet sites.	Spring through early fall.
BROWSE:			
Summersweet clethra (<i>Clethra alnifolia</i>)	Scattered	Margins of waterways and swamps.	Winter and spring.
American cyrilla (<i>Cyrilla racemiflora</i>)	Common	Margins of waterways and swamps.	Spring and late fall.
Dahoon (<i>Ilex cassine</i>)	Common	Sandy acid soils	Fall and winter.
Yaupon (<i>I. vomitoria</i>)	Common	Moist to dry sites. Prefers sandy soils with permeable subsoil.	Fall and winter.
Blackgum (<i>Nyssa sylvatica</i>)	Abundant	Moist to dry soils	Spring and summer.
Sawpalmetto (<i>Serenoa repens</i>)	South Carolina to Florida, and Louisiana. Abundant.	Sandy ridges to swamps	All year.
Greenbriers (<i>Smilax</i> spp.)	Common	Moist to dry sandy soils	Winter and early spring.
Elliott blueberry (<i>Vaccinium elliotii</i>)	Scattered	Acid soils	Winter.

¹ Except when specific States are mentioned, the species are found throughout the longleaf and slash pine forests.

Forage Quality

Forage is most nutritious in spring and summer, and cattle weight gains are highest then. During this period mature cows, from herds grazing bluestem range and producing 75 to 80 percent calf crops, gain an average of about 165 pounds each. Pineland threeawn forage is not as nutritious as bluestem forage in summer, and cows grazing the threeawn gain less. In south Georgia dry cows on pineland threeawn range gain about 155 pounds during spring and summer. Wet cows do little more than maintain body weight and may lose 50 pounds or more per head during this time.

Nutritive value of the forage declines in fall and winter. Even when fed protein and mineral supplements, cows that calve during the winter will lose about 200 pounds on bluestem range. Dry cows generally lose less than 75 pounds. Pineland threeawn forage is so low in nutrients during the winter that cattle are ordinarily taken from the range and put in feedlot or on improved pasture.

The range manager can influence forage quality considerably by controlling the closeness of grazing and making prescribed burns. Detailed information about prescribed burning will be found on pages 7 and 8. The quality of range forage is judged by protein and mineral content and by digestibility.

Crude protein.—Protein is essential for cattle growth, weight gains, appetite, and milk secretion and regular oestrus in cows. New grass shoots are relatively high in crude protein.

On pineland threeawn ranges in Georgia, grass contains approximately 6 percent crude protein in spring, but if the range is burned in winter the spring forage will ordinarily have 10 to 12 percent. Three to four months after grass growth begins, the crude protein falls below 6 or 7 percent, less than the minimum needed by a cow that is nursing or carrying a calf.

New grass growth on unburned bluestem range normally contains 8 to 9 percent crude protein in spring. On ranges burned in late winter or early spring, the percent will be from 10 to 12. In July and August, protein content is about 7 percent, or slightly higher if summer rains bring on a new surge of growth. In winter, it may fall to 3 or 4 percent.

Repeated grazing has much the same effect as burning in increasing the succulence and protein content. Cattle continually seek out plants previously grazed. In Louisiana, bluestem forage that was frequently harvested contained 9 to 11 percent crude protein, while that on unharvested plots had 5 to 6 percent.

Protein holds up best through the summer on ranges containing carpet-grass, bluestem, and some of the taller bunchgrasses, such as lopsided Indian-grass and switchgrass.

Forbs, especially legumes, are often higher in protein than grasses. Swamp sunflower may contain up to 10 percent in late summer and early fall. Seed heads of sunflower, certain legumes, and other forbs often have more crude protein, and also more minerals, than the leaves.

Spring growth of browse plants such as summersweet clethra, American cyrilla, and blackgum often has 13 percent crude protein. The evergreens, dahoon and greenbriers, are sought in winter when green feed is scarce. Their protein content of 8 to 10 percent exceeds that of leached herbaceous plants. Although browse contributes protein to the cattle diet in winter, it fails to compensate fully for deficits of other forage.

Where browse plants form dense thickets and grow beyond the reach of cattle, burning will open up the clumps and induce new growth. Cattle

find the young vigorous sprouts more palatable and nutritious than the twig growth of older stems.

Phosphorus.—This is the mineral most often deficient in native forage. Marked deficiencies of phosphorus are accompanied by loss of appetite and reduced rate of gain in animals. They may eventually have “stiffs” or similar bone changes, and milk production and reproductivity of cows may be impaired. Phosphorus content usually decreases as plants mature. On unburned ranges, grasses may have less than 0.08 percent phosphorus for most of the year. On ranges burned in winter, phosphorus amounts to around 0.12 to 0.14 percent for about 2 months in spring. This is barely adequate for dry cows and considerably below the 0.18 percent required by pregnant and lactating cows. Most forage species are deficient in this element. Swamp sunflower and legumes are relatively high. In winter, evergreen browse ordinarily contains more than other plants.

Calcium.—Calcium is one of the most important minerals for bone-building, growth, and reproduction. In Louisiana, most forage has more than the 0.20 percent thought necessary for breeding herds. Swamp sunflower is exceptionally high at all growth stages.

Eastward into Georgia and Florida calcium in forage rarely exceeds 0.18 percent. Most browse is high in calcium, but cattle usually do not eat enough of it to compensate for the deficiency of the other forage.

Cobalt and copper.—These minor minerals may be deficient in vegetation in parts of the Coastal Plain. A lack of either cobalt or copper may cause loss of condition, stunted growth, diarrhea, and anemia in cattle. Both are likely to be deficient in vegetation in central and southern Florida. In Georgia, commonly grazed herbaceous plants are wanting in cobalt and borderline in copper. The deficits are probably balanced by plentiful cobalt in browse plants, such as blackgum and summersweet clethra, and by liberal amounts of copper in sawpalmetto and other shrubs. Cobalt and copper are adequate in bluestem forage of Louisiana during spring and summer, and cattle show no symptoms of deficiencies in winter.

Digestibility.—Information about the digestibility of native forage is scanty. On pineland threawn range in south Georgia, digestible crude protein of the grasses is almost adequate for lactating cattle in spring and summer but is extremely low in winter. Total digestible nutrients are enough for lactating cows from spring through fall. In winter, cattle should be taken off the range because forage then is so low in total digestible nutrients that protein and mineral supplements cannot economically make up the deficiency. The 25 to 30 percent lignin in some browse plants during winter undoubtedly contributes to low forage digestibility. In Florida weight losses of cows wintering on native range indicate that forage digestibility may be about the same as in Georgia. On bluestem range in central Louisiana, cattle wintered well when forage was adequately supplemented with cottonseed cake, plus loose salt and steamed bonemeal fed free-choice.

Guides to Use of Important Grasses

Some 15 to 20 grasses normally make up 80 to 90 percent of cattle diet on southern pine ranges. Management, however, is usually based on information about a few prevalent and important species that are discussed here.

Bluestem and associated grasses.—Slender bluestem furnishes best grazing in spring. With moderate to heavy grazing, it remains productive

during summer. On untimbered areas where it predominates, 1 to 2 acres will generally provide a cow-month of grazing. It is intolerant of shade. If unburned or ungrazed, it forms unpalatable wiry stems and seedstalks, and a rough builds up, which retards grazing and lowers yields. A burning cycle of 3 to 4 years is most appropriate for removing litter and top growth and keeping this species productive.

Pinehill bluestem withstands moderate grazing and prescribed burning, but close, repeated grazing and frequent fires are detrimental. It grows well beneath trees unless retarded by accumulations of pine litter. If there is no danger of damaging young pines, yearlong grazing may be practical where it and other tall-growing bunchgrasses are the main source of fall and winter forage.

Slender and pinehill bluestem often grow in mixed stands in the Gulf Coastal Plain and cannot be managed separately. Efforts should be made, however, to lessen the grazing intensity on pinehill bluestem by burning less frequently than on areas where slender bluestem predominates.

Other tall-growing bunchgrasses, such as big and little bluestem and switchgrass, respond to management much the same as pinehill bluestem. They will tolerate winter burns, but their inability to withstand close grazing accounts, partially at least, for their relative scarcity throughout the Coastal Plain.

Recommended utilization for the bluestem type is removal by the cattle of about 40 to 50 percent of the foliage of the predominant grass species.

Pineland threeawn and associated grasses.—Pineland threeawn is a bunchgrass with long wiry leaves. It furnishes best grazing in spring after being burned. Cattle should be kept off midwinter burns until the grass is 6 to 8 inches tall. Otherwise the cows may not find enough to eat, and the close grazing will damage the forage plants. Utilization to remove 30 to 40 percent of the foliage is recommended. Blades of pineland threeawn pull from the plant so easily and inconspicuously that very careful observation is required to determine the degree of grazing. As the grass matures, it becomes less palatable and nutritious, and much of the foliage remains ungrazed.

When unburned, pineland threeawn is grazed very little, and the main diet of the cattle is warm-season grasses. Grazing should then be delayed to early summer and the acreage allowance per cow increased accordingly.

Curtiss dropseed grows as dense tufts or small bunches in close association with pineland threeawn. It thrives with frequent burning but is not easily smothered by dead herbage and forest litter. If ungrazed, it tends to increase with continued fire protection. It remains conspicuously green in winter and attracts cattle after other grasses mature. Where abundant, Curtiss dropseed furnishes more forage and is grazed more heavily than any other grass during the fall and winter. On moderately stocked ranges it is grazed sparingly in summer; heavy use signifies a definite scarcity of palatable herbage. As with pineland threeawn, light grazing is difficult to detect.

Creeping bluestem grows as single stems or as very small and scattered tufts. Its slender underground stems distinguish it from other bluestems. New leaves and regrowth are grazed readily in summer. Young seedstalks are preferred forage in late summer. Creeping bluestem withstands moderate grazing but declines if heavily grazed. Changes are unrelated to burning.

Lopside Indiangrass is so named because of the long-awned seeds hanging from one side of the panicle. Its leaves are eaten in the spring and summer, and the emerging flower stalks are eaten in late summer and fall even where a wide variety of other forage, including improved pasture, is available. This bunchgrass persists with light grazing but decreases when eaten closely. Though it tolerates frequent fires, it also grows well on unburned ranges.

Carpetgrass and panicums.—Carpetgrass and panicums occur throughout longleaf and slash pine forests. Carpetgrass withstands heavy grazing better than most native species. In fact, it is abundant only where grazing is frequent and close. For this reason, and because it forms sod, it is often seeded on grazed firebreaks.

Two general types of panicums are easily recognizable in longleaf and slash pine forests. One has three distinct seasonal growth phases. In winter these plants form a ground-hugging rosette of green leaves valuable in cattle diet when other forage is scarce. In spring the plants send up leafy but unbranched flower stalks with prominent panicles that are relished by cattle as long as they are succulent and tender. In fall the flower stalks become branched and bushy.

Panicums of the second general type bloom only in late summer or fall and do not form rosettes. Switchgrass, the most important member of this group, decreases with heavy grazing. When ungrazed, and if in large enough patches, it may be cut for hay.

Maidencane is one of the most palatable panicums. Underground stems produce a heavy growth of leafy shoots that emerge in early winter and become 3 to 5 feet tall during the growing season. They provide excellent winter forage. In mild years, the foliage may stay green all winter.

Calculating Proper Grazing Use

Stocking the range at a proper rate is an essential of good management. The first step in deciding on stocking rate is to determine how much forage is available. One way to accomplish this is to clip vegetation in late summer or fall from sample plots on ungrazed ranges or from ungrazed parts of grazed ranges (fig. 2). Clusters of two plots at each of 30 locations are usually enough on a bluestem range. On a pineland threeawn range, 50 locations may be needed.

Cluster locations may be marked in a grid on a map or photo of the range unit or located by pacing specified distances along a compass line in the field. A 160-acre range unit will have approximately 50 clusters at a grid spacing of 375 feet.

A square plot measuring 3.1 by 3.1 feet, or a circle 42 inches in diameter, is convenient. The range examiner should make a frame of the desired size and shape, to save the trouble of drawing the outline of the plot on the ground. The procedure for taking the forage sample is as follows:

Stand at the first sample point, and place the frame on the ground directly in front of you, regardless of what it falls on (do not try to avoid browse and other woody vegetation).

Within the area of the frame, clip all current annual growth, including edible parts of browse plants up to a height of 5 feet above ground.

Put the clippings in a paper sack, weigh them, record their net green weight, and then discard them.



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FIGURE 2.—Forage yields and proper grazing use can be estimated by clipping forage from a series of small plots.

Take 10 steps to the right, and repeat the procedure for the second plot of the cluster.

Repeat at each of the 30 or 50 sample locations—a cluster of 2 plots at each location.

If weights are taken in grams, multiply by 10 to get pounds per acre. If weights are in ounces, multiply by 283 to get pounds per acre.

The average of the individual plots is the yield per acre for the range unit. Grass forage averages about 50 percent moisture in the fall, and therefore green weights can be used for calculating proper range use.

Not all the current growth is usable by cattle. Enough must be left so that plants can set seed or store food to begin growth the following season. As a general rule, the best combination of gains per acre and per cow is attained with moderate grazing—about 45 percent of current growth. Light utilization, about 30 percent, gives the greatest gains per animal. Heavy utilization, about 60 percent, may temporarily produce the most beef per acre, but frequently at the expense of good range condition. On slender bluestem ranges, though, heavy utilization may be desirable to prevent formation of unpalatable stems and seedstalks.

If, as is often recommended, the objective is to remove 45 percent of the vegetation, the per-acre weights would be multiplied by 0.45 to determine the forage available for grazing. This figure, divided by the daily con-

sumption per cow (50 pounds of green forage), equals the number of days of grazing per acre. The number of days in the grazing period divided by the days of grazing per acre equals the number of acres needed per cow.

For example, if the average green weight of forage per acre on a range is 3,000 pounds and 45 percent is considered usable, the number of days of grazing per acre by a cow consuming 50 pounds of forage per day would be 27. If the intention is to graze the range from mid-March to mid-October (210 days), approximately 8 acres would be needed to provide ample forage.

Approximations of safe stocking generally suffice for management purposes. Table 2 suggests stocking rates for ranges varying in production, grazing use, and season.

To measure forage yields on ranges with herds on them is often impractical. Attaining proper utilization is largely a matter of finding how much forage is being eaten and adjusting cattle numbers accordingly. The task is difficult, and more often than not decisions will have to be based on experience. Following are some guides for estimating utilization:

Light use (25-30 percent forage removal): grazing patchy and leaf tips bitten off less than three-fourths of the grass tufts. No obvious removal of leaves from pineland threeawn.

Moderate use (40-45 percent forage removal): leaf tips bitten off more than three-fourths of the grass tufts, but occasional patches ungrazed. Obvious pulling of center leaves from pineland threeawn.

Heavy use (60-70 percent forage removal): leaf tips bitten off all grass tufts and average stubble height 4 inches or less. Most center leaves pulled from pineland threeawn.

TABLE 2.—Acres needed to graze a mature cow at a desired forage-utilization level on ranges varying in production

Forage per acre, green weight (pounds)	Forage utilization (percent)	Acres per cow when grazing period is—				
		90 days	150 days	210 days	270 days	360 days
1, 000	30	15	25	35	45	60
	45	10	17	23	30	40
	60	8	12	18	23	30
2, 000	30	8	12	18	23	30
	45	5	8	12	15	20
	60	4	6	9	11	15
3, 000	30	5	8	12	15	20
	45	3	6	8	10	13
	60	3	4	6	8	10
4, 000	30	4	6	9	11	15
	45	3	4	6	8	10
	60	2	3	4	6	8
5, 000	30	3	5	7	9	12
	45	2	3	5	6	8
	60	1. 5	2. 5	3. 5	4. 5	6

Coordinating Forage With Timber

Maintaining grass beneath trees.—Grass yields in southern forests are highest when trees are small. As the pines grow and their crowns close, forage declines. Rarely, though, is grass eliminated. Over the bulk of the range, it persists in varying amounts. Yields of grass are least beneath dense pole-sized stands, but increase as trees grow larger and taller and some are cut.

Natural longleaf stands generally are more open and have more forage than slash pine stands. When number, height, and size of the trees are the same, probably about as much grass grows in slash pine stands as in longleaf.

The relation between trees and grass is much the same for planted pines as for natural stands. The main difference is in tree spacing and forage composition. In natural or seeded stands the young trees, particularly slash pine, often form thickets under which grass declines rapidly. In plantations, spacing between trees can be controlled at the beginning to encourage grass growth for several years.

Furrowing, disking, or other soil disturbance incident to planting or seeding encourage carpetgrass and common Bermuda grass at the expense of native bunchgrasses. These invading species are less tolerant of shade and litter and, as the timber stand develops, may be expected to give way to bluestems, panicums, threeawns, and paspalums.

As the pines grow, thinnings are necessary for optimum production of timber and grass. The first thinning usually comes when trees average about 6 inches in diameter—big enough for pulpwood. After that, thinnings are at regular intervals, perhaps every 5 years. Table 3 indicates the number of trees that should be left after each thinning for optimum production of trees and grass: ¹

Average diameter of trees (inches):	Trees per acre (number)
6.....	458
8.....	258
10.....	165
12.....	115
14.....	84
16.....	64
18.....	51
20.....	41

Pine litter rapidly accumulates beneath well-stocked timber stands and, unless removed by occasional prescribed burns, will drastically reduce grass growth.

Prescribed burning.—In the longleaf-slash pine belt, forage and timber management are closely linked to prescribed burning. If done properly, burning improves the palatability, quality, and availability of grasses (fig. 3). From the standpoint of the timber grower, it is useful to control undesirable hardwoods, reduce the hazard from wildfire, prepare seedbeds, and control brown spot on young longleaf pines.

Here is some general advice for making a prescribed burn to accomplish one or more of the objectives just mentioned:

Notify the nearest State or Federal fire protection agency, and

¹ These stocking rates are equal to a basal area of 90 square feet per acre, which is assumed to be a desirable density for southern pines.



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FIGURE 3.—Grass growth is good beneath this stand of longleaf pine that has been regularly prescribe-burned to control undesirable hardwoods and reduce the hazard of wildfire.

ask for advice on how to keep the fire in bounds and prevent it from damaging timber.

Burn in winter, roughly between December 1 and February 15.

To keep the fire from spreading to places where it is not wanted, supplement natural firebreaks (such as roads and streams) with plowed lines.

Before burning, inspect the fuel, get weather information, and notify owners of adjoining land.

Burn soon after a rain, usually within 4 days,

Burn when a cool wind is blowing from a northerly direction at 3 to 10 miles per hour.

Set fires along the downwind firebreak (so that they will burn against the wind) and patrol constantly. Have on hand the help, tools, and equipment for keeping the fire under control.

Except on some lands in south Florida where timber growing is secondary to cattle grazing, burning for forage improvement should be done only after timber and other forest uses have been fully considered. Where new pines are being started, fire must usually be excluded until the trees are 8 to 10 feet tall, except as burning is necessary to reduce brown spot needle infection of longleaf seedlings in the grass stage. Thereafter, it may be used advantageously at 2- to 5-year intervals.

In some sections of south Florida, separate parts of the range are occasionally burned at different seasons to maintain grazing the year round.

Table 4 gives burning schedules in which the needs of both timber and forage are recognized.

TABLE 4.—Recommended grazing and burning schedules for protecting trees under changing forage and timber conditions

Timber stand condition	Grass yields per acre (green weight)		Burning schedule	Grazing schedule		
	Pineland threecawn			Bluestem, yearlong	Pineland threecawn	
	Bluestem				Georgia, spring and summer	South Florida, yearlong
No trees One-year-old seedlings.	<i>Pounds</i> 3, 000 3, 000	<i>Pounds</i> 2, 000 2, 000	2-3 years Exclude fire	15 acres per cow Exclude cattle or graze lightly—20 acres per cow. Grazed lightly—23 acres per cow. Grazed slender bluestem heavily, other bluestems moderately—30 acres per cow.	14 acres per cow Exclude cattle or graze lightly—20 acres per cow. Grazed lightly—30 acres per cow. Grazed moderately—26 acres per cow.	23 acres per cow. Exclude cattle or graze lightly—30 acres per cow. Grazed lightly—40 acres per cow. Grazed moderately—45 acres per cow.
Seedlings and saplings, less than 8 feet tall. Saplings, taller than 8 feet but less than 6 inches in diameter.	2, 600 1, 400	1, 600 1, 000	Exclude fire 3-4 years	Grazed lightly—23 acres per cow. Grazed slender bluestem heavily, other bluestems moderately—30 acres per cow.	Grazed moderately—39 acres per cow.	Grazed moderately—66 acres per cow.
Pulpwood, 6-12 inches in diameter.	650	700	2-4 years	Grazed slender bluestem heavily, other bluestems moderately—60 acres per cow.	Grazed moderately—39 acres per cow.	Grazed moderately—66 acres per cow.
Sawtimber, 12 inches and larger in diameter.	1, 400	1, 200	2-4 years	Grazed slender bluestem heavily, other bluestems moderately—30 acres per cow.	Grazed moderately—22 acres per cow.	Grazed moderately—38 acres per cow.

Protecting trees from cattle.—On most longleaf-slash pine ranges, grazing must be modified to prevent cattle from concentrating where pines have been planted or seeded. Burning or feeding is often sufficient to draw the herd to other parts of the range, but sometimes fencing off the young pine stands is necessary. When pines are being planted, applying chemical repellents to them may be desirable.

With cattle grazing the ranges, some trampling of young pines is inevitable. Injury to seedlings is usually not serious unless grazing is heavy. The most critical period is late fall and winter, when green forage is so scarce that the cows may browse as well as trample pines.

When it is necessary to run cattle on the range all year, grazing pressure on areas with young seedlings can be reduced by burning less vulnerable parts of the range. In preparation for pine regeneration, an area may be burned in late winter and grazed moderately the following spring and summer. Longleaf or slash pine can then be seeded or planted during the winter and cows drawn away by burns on other parts of the forest. The burned areas should be large enough to provide ample forage for the cattle.

Under light to moderate grazing, serious injury to young pines can usually be avoided if cattle are removed from the range in fall, before the grasses become dry and unpalatable, and are not returned until ample green forage is available in the spring.

Where cattle frequently damage young pines, fencing is the only sure way of protecting the trees. Stands of slash pine seedlings may need to be fenced for only 2 or 3 years, but longleaf pines need protection until they are well out of the grass. A barbed-wire fence of three strands will turn cattle. A four-strand fence is better. Electric fences are seldom satisfactory in the woods.

A special situation exists where hardwoods are eradicated by mechanical or chemical means in preparation for planting pines. Unless fenced out or kept away by other methods, cattle concentrate on such planted areas and frequently destroy most of the seedlings.

As a temporary preventive, seedlings can be treated with chemicals. Copper carbonate has been the most effective repellent to date. On a range with extremely heavy cattle concentrations in central Louisiana, about half of the seedlings treated with this chemical escaped with little or no grazing. Untreated seedlings were killed or damaged.

The repellent is applied by spraying or dipping the seedlings immediately before they are planted. It is prepared by mixing 1 gallon of asphalt emulsion, available at many building-supply stores, with 6 gallons of water and adding 5.7 pounds of copper carbonate (0.55 percent metallic copper, of the light, fluffy, commercial grade). The mix will treat about 12,000 seedlings, and the cost is small.

Copper carbonate must be used cautiously, as it is somewhat toxic to young seedlings. Damage usually is not serious when the soil is moist, but during droughts the copper carbonate may increase the number of seedlings that die. It is best to plant seedlings the same day that they are treated. They are likely to be damaged if held for more than a day, especially if they are stored in bundles.

Combinations of Range and Improved Pasture

Used together, range and improved pastures are dependable sources of year-long forage. Combinations are especially suitable for cattle owners who have neither sufficient range nor improved pasture to support herds of

practical size—25 head or more. Because forage from improved pastures is higher in crude protein and minerals than most native forage, such pastures improve the condition of cattle and thus better the calf crop.

Pasture species.—Coastal Bermuda grass and Dallis grass grow well in much of the south. Pangola is very productive in Florida. Pensacola Bahia grass does well in the southernmost coastal areas. Overseeding with lespedeza and white clover increases yields, extends the grazing period, and contributes to soil nitrogen fixation. If they are to be successful, pastures must be fertilized liberally. Recommendations on species and fertilizer schedules for specific soils, sites, rainfall, and temperatures are best obtained through the local agricultural extension agent or technicians of the Soil Conservation Service.

Livestock distribution and grazing schedules.—Whenever possible, ranges should be separated from improved pastures by fences. Cattle can then be confined to the range or pasture as needed to get the desired use in each unit.

To assure regeneration of pasture legumes, grazing pressure must be light while these plants are flowering and seeding.

During the spring and early summer, native forage should be grazed and some of the improved pasturage cut for hay. One or two crops can be harvested each year. The hay from 1 acre—1.0 to 1.5 tons—is ample to feed a cow in drylot for 3 to 4 months.

One-half to one acre of moderately fertilized pasture in combination with 10 to 20 acres of range will usually produce enough forage and hay to care for a cow all year. The ratio of pasture to range varies widely by areas and operations. In many parts of the longleaf-slash pine forest type, improved pasture is the major source of forage, with range contributing less than half during the growing season and small amounts in winter.

The following schedule for grazing and feeding cattle and harvesting hay is applicable to areas other than south Florida:

<i>Mar.-Apr.</i>	<i>May-July</i>	<i>Aug.-Oct.</i>	<i>Nov.-Feb.</i>
Grazed improved pasture or pasture-range combination.	Grazed range; harvest pasture for hay.	Alternately graze range and pasture.	Feed hay in drylot; graze range and pasture lightly as available.

In south Florida drylot feeding may be unnecessary. In one operation, four 20-acre pasture units of pangola, Pensacola Bahia-indigo, Pensacola Bahia-clover, and Coastal Bermuda were grazed one at a time in rotation. At the same time cows had free access to 320 acres of range, 160 acres of which was burned each year—80 in early December and 80 in late January. The cattle got 30 to 40 percent of their feed from the native range. The combination supported 65 cows that produced 80 percent calf crops. Weaned calves weighed 425 pounds.

In another case, cows had free access to pasture and range except for 2 to 3 months in winter, when they were excluded from the pasture to permit a buildup of white clover. The range was burned in late fall to provide green forage for winter. Cows were turned back into pasture in late winter and early spring to take advantage of the luxuriant clover during the breeding season. One acre of improved pasture replaced about 10 acres of range.

Grazed firebreaks.—These are strips of improved pasture that serve as barriers to fire. They not only produce good forage for most of the year

but also improve the distribution of cattle over the range.

Firebreaks should be located so as to take advantage of natural barriers to fire and provide a route of travel for firefighting crews and equipment. Sites too wet or dry for good forage plant growth should be avoided. Ordinarily the breaks will divide the forest into units of 40 to 320 acres. A uniform strip width of about 65 feet is preferred, and 16 feet is a minimum.

Firebreaks should be cleared of woody plants and shrubs, seeded to appropriate mixtures of grasses and legumes, and fertilized and limed according to plant and soil requirements. Then, if they are to be good fire-stoppers, they must be kept clean by grazing, mowing, and weed control.

Seeded firebreaks are nearly always grazed closely if unfenced. If the cost of fencing is not excessive, firebreaks should be separated from the rest of the range. Then forage utilization can be regulated to good advantage. Depending on the amount and availability of range forage, cattle can be confined to the woods during droughts or at times when forage on the breaks is scarce. Cattle spend little time in the woods when growth on the breaks is lush; in fall, when the breaks have been closely cropped, the cattle get most of their forage from the woods.

If winter annual grasses are seeded into the summer-grass sod, grazing should begin when the annuals are 6 to 8 inches high. On the average, this will be in late December or early January. Moderate to heavy grazing should continue through spring and summer until winter annuals are seeded in the fall. Cattle are then confined to the range or put in feedlots until the seeded grasses are again available for grazing. If winter grasses are not planted, the grazing season will normally extend from late March to October or early frost. Firebreaks can be stocked for the entire grazing season at rates of $\frac{3}{4}$ to 1 acre per mature cow.

Control of Undesirable Plants

On many southern forest ranges, growth of both forage and timber is hampered by weed plants. The most troublesome are gallberry (*Ilex glabra*), sawpalmetto, and various species of scrub hardwoods.

Gallberry and sawpalmetto are most prevalent in the flatwoods of Florida and south Georgia. Though sawpalmetto fruits are eaten by wildlife and the leaves are grazed by cattle, the plants restrict growth of more desirable forage species. Prescribed burns at intervals of 3 or 4 years keep gallberry and sawpalmetto in check, but the rootstocks survive and soon send up new shoots. Spraying in August with 2,4,5-T (2 to 3 pounds acid equivalent per acre for gallberry, 3 to 4 pounds for sawpalmetto) kills the entire plant but is expensive. Bulldozers and rootrakes are commonly used to clear sawpalmetto for improved pastures.

Scrub oaks and other poor-quality hardwoods can be killed by applying an oil solution of 2,4,5-T ester with a tree injector or in frills or girdles made with an ax. About 2.5 gallons per acre is the average amount needed for most operations. Recent research shows that blackjack and post oaks may be killed with undiluted 2,4-D amine—0.5 milliliter per injection in cuts spaced 3 inches apart, edge to edge, near the ground line. For hard-to-kill species like red oak and hickory, injections should be spaced 1 inch apart or undiluted 2,4,5-T amine should be used at rates of 1 milliliter per injection in cuts 3 inches apart. Broad-scale spraying is not generally recommended in good timber-producing areas because the valuable commercial hardwoods are likely to be killed along with the worthless ones.

In consideration for wildlife, the U.S. Forest Service recommends leaving 4 to 5 acres of mast-producing hardwoods per "forty" in depressions and along streams on National Forest lands in the South.

Deadening unwanted hardwoods may increase grass considerably. In central Louisiana, bluestem forage averaged 2,415 pounds (air-dry) per acre on plots where blackjack and post oaks were killed 2 years previously; untreated plots had 675 pounds. The grasses from treated plots were higher in crude protein and phosphorus than those from untreated plots. Grass production remained high for several years, and then gradually declined under the shade of pines that were planted when the hardwoods were killed.

Cattle and Their Management

Range Cattle Breeds

Until about 1940, most southern range cattle were descendants of those brought in by the early Spanish settlers. These so-called native cows had the ability to survive under adverse conditions but were poor meat producers. Although the herds are still of generally low quality, cattle owners have been gradually improving them by using bulls of Brahman and British breeds.

On low-quality forage, range cattle with Brahman blood apparently do better than cows of predominantly British ancestry (fig. 4). In tests in southern Georgia over a 6- to 7-year period, calf crops of cows having one-half Brahman blood were 85 percent and calves weaned in October averaged 480 pounds. Grade Hereford cows bred to the same bulls and carried on the same range had 67 percent calf crops; weaned calves weighed 412 pounds.

Stockmen ordinarily develop their own crossbred animals. A proved system in south Georgia and Louisiana is to breed native cows to a good Hereford, Shorthorn, or Angus bull. The progeny is then bred to a Brahman bull to produce an animal that serves very well as a mother cow. These cows when bred to a British bull produce calves that weigh over 400 pounds at weaning and grade commercial to good. In south Florida, it is common practice to breed the native cow to Brahman bulls, and also breed the female offspring to Brahman bulls. A third cross with British-bred bulls on the crossbred native-Brahman cows produces a calf having the beefy characteristics of British breeds and the heat resistance imparted by the Brahman.

Cows with Brahman blood sometimes are considered harder to handle than cattle of predominantly British breeds. However, those who work with Brahman cattle learn their herding and driving habits and can handle them very well. Brahmans are no more difficult to keep under fence than other cattle, but corrals, chutes, and equipment for working them should be 1 or 2 feet higher than for most other breeds.

Cattle Handling Facilities

In the past, most forest ranges were unfenced. Cattle roamed at will, and carrying on recommended feeding and breeding practices was difficult. Now most States require livestock to be fenced from highways. Although adding to the cost of grazing, fences permit a landowner to keep out other peoples' cattle and to have firm control of his own. Where the landowner



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FIGURE 4.—Cows with some Brahman blood are best producers on Southern forest ranges.

and cattleman are different people, fences enable them to make lease agreements on the use of forests for grazing.

For cows, a four-strand barbed-wire fence with posts set 16 feet apart is suggested. A woven-wire fence is essential if the forest owner needs to exclude hogs from stands of longleaf pine seedlings.

Many southern forest ranges have live streams, but frequently a stock-watering facility is needed to provide permanent water and regulate livestock distribution. Ponds are usually the cheapest form of construction, but in droughts they are less dependable than wells.

Cattle are generally rounded up regularly for spraying, castrating, weaning, branding, and observation. Board corrals, 6 feet high and with two or more separate pens, greatly facilitate cattle handling. The posts and boards should be treated with preservatives.

Supplemental Feeding

Range forage must be supplemented if cattle are to thrive. Without supplements, susceptibility to parasites and disease is high, malnutrition results in heavy death losses, average calving percents seldom exceed 50, and weaned calves frequently weigh less than 300 pounds. If the cattle and forage are managed well, supplemental feeds raise calving percentages to around 80 and weaned calf weights to 400 pounds or more. Late fall and winter are crucial for supplemental feeding.

Protein concentrates.—Cottonseed meal or pellets (41 percent crude protein) are the most widely fed and practical protein concentrate. Normally feeding starts in October or November, but it should begin earlier if crude

protein of forage drops below 7 percent, or if cows show signs of losing weight rapidly. During the fall 1 to 2 pounds per animal per day will be sufficient. When cows remain on range, the rate should be stepped up to 3 pounds per day for the 2 to 3 winter months when forage quality is lowest. Feeding may stop after forage greens up in spring. About 375 pounds per animal each year is enough on most ranges. The best place for meal is in troughs, but pellets may be scattered on the ground without excessive loss. Troughs should be moved occasionally to prevent the vegetation from being trampled out.

Some stockmen mix cottonseed meal with salt and place it in self-feeders. This procedure lets cattle eat at will and cuts down on labor. Consumption is governed by the ratio of salt to meal. On the average, one part of salt to four of cottonseed meal limits intake of the meal to about 2 pounds daily. If greater intake is desired, less salt is added.

Feeding protein concentrates during spring and early summer has not proved practical.

Phosphorus and calcium.—These minerals should be accessible in feedboxes all year. Steamed bonemeal (32 percent calcium, 15 percent phosphorus) is most widely used and with apparent good results. To induce consumption and prevent spoilage, two parts of meal are often mixed with one part of salt. Yearly consumption of this mineral mix varies from 18 to 75 pounds per head according to weather, quality of forage, and mineral content of other feeds. If a greater intake is desired, molasses or cottonseed meal can be added to increase palatability.

Minor mineral elements.—Minor elements are often added to mineral mixtures as a precaution, but the only area of demonstrated need is south Florida. Mixtures suitable to this area contain red oxide of iron (3.12 percent), copper sulfate (0.63 percent), and cobalt chloride or cobalt sulfate (0.04 percent).

Breeding Season

The breeding season for cattle on forest range is best limited to about 3 months so that all calves can be weaned and marketed at one time. When calves are dropped throughout the year, extra time and money are required to raise them, and the feeding and grazing schedule of cows is more complicated.

Long breeding seasons are unnecessary. If a cow does not settle within 3 or 4 months, during which she will normally come into oestrus 4 or 5 times, chances are high that she would not breed that year with a longer season. Even if she did conceive, the calf probably would need special handling and wean at a low weight.

The generally mild temperatures permit calving during the winter, whether cattle are in feedlot or on the range. Studies in Louisiana indicate that it is practical to place the bull with the herd from late February through June. Most calves are then dropped in December through March, and are old enough by spring to eat the new grass and take advantage of the period of highest milk production of dams. Calf weight gain up to weaning time, including the birth weight, averages 2 pounds per day. Weaning in early August enables cows to retain or put on flesh for the winter.

In herd-management studies in south Georgia, the breeding season extended from April 15 to July 1. Most calves were born in late January and February and remained with cows until mid-October. By this time forage quality was low, cows had lost weight, and the calves' rate of gain had

slackened. Earlier weaning would have permitted cows to be in better condition for winter.

Marketing

Except for cull cows, most range beef animals are marketed as slaughter calves at weaning or as feeder stock. The majority are sold through local auctions and generally grade Commercial. A few calves are sold at ages of 5 to 6 weeks as veal. If calves are retained as feeders or replacement heifers, only the best should be selected. In the long run they will be most profitable, either in the herd or in the feedlot.

A range cattle producer operates under certain marketing limitations. Weaner calves are generally sold in early fall when prices are down. The market is better earlier in the season; consequently, if calves are born in early winter they can be sold at a decided price advantage in July and early August, as has been demonstrated in experimental herds in Louisiana. Although the total weight of the calf may be less, this lower weight is usually compensated for by the price.

Cattlemen with necessary handling facilities and plenty of feed may overwinter weaner steers to be grazed the following spring and summer. The steers normally gain about 160 pounds in 7 months, with the most rapid gains coming in spring and summer and the maximum weight reached by August. But if steer gains are below average, they may not offset the cost of wintering, and therefore the practice is not generally recommended.

Herd Improvement

Continual efforts are needed to better the herd. Cows on a fairly high maintenance level should calve 3 out of 4 years, with calves weighing more than 400 pounds at 6 to 8 months of age. Cows failing to meet these standards should be replaced. When the condition of cows is poor, accurate culling is difficult, because undernourished cows, particularly heifers, will not often conceive while suckling a calf. In selecting replacements the best choice is heifers from high-producing dams or from herds of known production. Heifers larger than average and from bred-up stock containing some Brahman blood are preferable.

Heifers should be 2 years old when first bred. If bred as yearlings, they are more apt to die at calving, or if they survive, are not very likely to have a calf the following year.

Whatever breed is chosen, fast-growing bulls that were raised largely on roughage are desirable. Performance-rated purebreds are best if available. Testing bulls for fertility before putting them with the herd is wise. Good bulls should be retained until their breeding efficiency declines or until inbreeding with their progeny becomes a problem. Normally, they will be rotated or replaced every 3 to 4 years.

Cows should be kept as long as they consistently wean heavy calves. Well-nourished range cows do not seriously decline in productivity until they are at least 10 to 12 years old.

Herd Health

All range calves need to be vaccinated against blackleg and malignant edema. It is good practice to vaccinate against Bang's disease all heifer calves that will go into the breeding herd. Hornflies should be controlled;

a list of approved spray materials can be obtained from the State Agricultural Extension Service.

Where range cattle are not concentrated, internal parasites may not be serious. However, liver flukes, lungworms, and gastro-intestinal worms sometimes infest local herds. If treatment is needed, consult your local veterinarian, County Extension Agent, or State University for treatment methods.

Costs and Returns

As in any other business venture with relatively small working margins, the forest grazing enterprise has to be well managed. Size and kind of herd, amount and type of range, and quality of facilities are important, but the difference between profit and loss depends mostly on the skill of the operator.

Possibilities of well-managed operations on bluestem range were demonstrated by a herd that was grazed for 5 years on the Palustris Experimental Forest, near Alexandria, La. The 25-cow herd had yearlong access to a section of range. No improved pasture was available, but each cow received about 375 pounds of cottonseed cake during fall and winter.

Investment per cow was \$285. Fencing and cost of cow comprised nearly 75 percent of this amount. Other costs included watering facilities, corrals, bulls, feed troughs, storage sheds, veterinary supplies, and miscellaneous items.

Operational costs were \$48.85 per cow annually of which \$18.60 was spent for feed and \$13 for labor. Range burning, forage surveys, care of bull, replacement of cows, protection of tree seedlings, taxes, and upkeep of corrals, fences, and troughs were major items of other expense.



F-453646

FIGURE 5.—These cows were good moneymakers on bluestem range in Louisiana.

Weaned calves averaged 424 pounds. Sale prices ranged from 15 to 28 cents per pound. At an average of 22 cents, the market value per calf was \$98.28. The average calf crop was 83 percent, with the gross annual return per cow \$77.42. Subtracting from this \$48.85, the cost of operation, left a net return of \$28.57 or 10 percent annual return on the investment per cow (fig. 5).

The threeawn ranges of south Georgia and north Florida are less profitable. For experimental herds at Alapaha, Ga., annual feed costs per cow were about \$7 more than they were for cows on bluestem ranges in Louisiana, because the cows were in a feedlot during winter. The greater cost of feed, coupled with a lower calf crop (around 77 percent), reduced the net return per cow to \$16, or about 5½ percent on the investment. Here, as in the Louisiana operation, land costs were charged off to timber production.

In south Florida vast acreages are used for grazing only, and therefore all land investment costs are chargeable to cattle (fig. 6). Where range and improved pasture are grazed in combination (1¼ acres of improved pasture plus 5 acres of range per cow), land investment averages at least \$125 for rangeland and \$75 for improved pastures, making a total of \$200 per cow. The total investment per cow, including fences, watering facilities, and cost of the animal, is approximately \$423. Operating costs are about \$63 per head. With expected gross returns of \$75 (based on 80 percent calf crop, weaned weight of 425 pounds, selling price of \$0.22 per pound), there would be a net return of \$12, or approximately 3 percent on the total investment.



F-502248

FIGURE 6.—Large acreages in south Florida are used primarily for grazing, with timber as a secondary crop.

The foregoing estimates do not take into account the indirect benefits of forest grazing. Cattle are valuable collateral in negotiating loans. They offer a way of using off-season and spare-time labor efficiently. Grazing aids in keeping down the grass rough and reducing fire hazard. The fences and continued observation of the herd aid in controlling trespass. Some forest landowners consider these incidental advantages to be as important as the direct income from beef.

Lease of grazing privileges.—Grazing rights are sometimes leased, and a question may arise as to the proper fee. One reasonable solution on blue-stem ranges in Louisiana is to accord the cattlemen an annual return of 6 percent on his investment and to divide returns in excess of 6 percent between him and the landowner. For example, the yearly grazing fee per cow might be computed as follows:

Net return before grazing fee.....	\$28. 57
Six percent on investment of \$285.....	17. 10
Net return above 6 percent.....	11. 47
Grazing fee per cow=one-half of net return above 6 percent.....	5. 70

For south Georgia and north Florida pineland threeawn ranges, this fee would be too high because the return on the cattle investment is lower than in Louisiana. Here a more realistic annual lease rate would be about \$2.25 per cow.

Sometimes the landowner furnishes the fence, water facilities, corrals, pastures, etc., and at other times they are furnished by the cattlemen. In either case, the party supplying these items should receive the agreed-upon percent on his investment in them.

In addition to grazing fees, leases should specify kind and number of cattle, season of use, area to be grazed, term for which the lease is to run, and penalties for breach of contract.

Summary of Recommendations

Learn to recognize the main forage plants on the range. Grasses, such as slender, pinehill, and creeping bluestem, pineland threeawn, and Curtiss dropseed, are most prevalent; but other grasses, forbs, and evergreen browse are important in adding variety to the cattle diet. For information on identification and growth habits of range plants, refer to publications listed on pages 24 and 25, and consult specialists from State experiment stations and from the Forest Service, Soil Conservation Service, and Extension Service of the U.S. Department of Agriculture.

Graze the range moderately to get the best balance between cattle gains per acre and per head.

Fully consider all forest uses before making prescribed burns. Generally exclude fires until trees are at least 8 to 10 feet tall. Thereafter, prescribe burn at 2- to 5-year intervals to improve forage, remove litter, reduce wildfire hazard, and control undesirable plants.

Thin trees regularly, first when they average 6 inches in diameter breast high and thereafter at about 5-year intervals.

Avoid grazing damage to pine seedlings by one or a combination of ways: Graze the range lightly to moderately, exclude cattle from range during fall and winter or year round until young trees are at least 3 feet tall.

To provide yearlong forage, develop improved pastures to supplement forest range. Cut pasture grasses in spring and early summer and store as hay to be fed in winter; 1 to 1.5 tons per cow is enough. Consider the possibilities of establishing improved pastures as firebreak strips through the forest.

Control sawpalmetto and gallberry with prescribed burning. Kill noncommercial hardwoods with 2,4,5-T applied in frills or girdles or by tree injector.

Fence the lands to be grazed. If range is being leased, have a written agreement.

Feed supplements: 375 pounds per cow of cottonseed cake or meal (crude protein) in fall and winter; steamed bonemeal (phosphorus and calcium) and salt free-choice yearlong; iron, cobalt, and copper all year in south and central Florida.

Maintain some Brahman blood in dams. Breed them to tested bulls of British breeds. Rotate or replace bulls every 3 to 4 years.

Restrict the breeding season to about 3 months so that calves born in winter can take advantage of good forage and the cows' maximum milk flow in spring.

Wean and market calves in late summer.

Cull cows that fail to raise a 400-pound calf 3 years out of 4. Select replacements from high-producing dams.

Vaccinate all range calves against blackleg and malignant edema. Vaccinate heifer calves against Bang's disease if they are to go into the breeding herd. Control hornflies.

Maintain a practical balance among cattle, forage, and trees. Do not go overboard in one phase and neglect another.

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